

IN THE CLAIMS

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1. (Currently amended) Transceiver apparatus (1, 1') for use in a multi-frequency communication system, comprising:

a signal processor, (DDS)

a frequency conversion circuitry (3, 3')

an antenna-switch (SW, SW') comprising a multi-switch, a transmission-multiplexer and a reception multiplexer, wherein said multiplexers are controllable by the signal processor,

a frequency conversion circuitry having a transmission path and a reception path, wherein each of the paths communicatively connects the signal processor and the antenna-switch, and

an antenna terminal (AT, A') having at least one a plurality of antenna, each antenna having a transmission-connector for connecting the transmission path to the antenna and a reception-connector for connecting the reception path to the antenna (A, A1, A2, A3, A4) characterized in that the frequency conversion circuitry (3, 3') has a transmission-path (Tx, Tx') and a reception-path (Rx, Rx'), wherein each of the paths communicatively connects the signal processor (DDS) and the antenna switch (SW, SW'), the antenna switch (SW, SW') comprises a multi-switch (MSW), a transmission-multiplexer (TxMUX) and a reception multiplexer (RxMUX), wherein said multiplexers (TxMUX, RxMUX) are controllable by the signal processor (DDS) via the multi switch (MSW), the antenna (A, A1, A2, A3, A4) has a transmission-connector (CT1, CT2, CT3, CT4) for connecting the transmission path (Tx, Tx') to the antenna (A, A1, A2, A3, A4) and a reception-connector (CR1, CR2, CR3, CR4) for connecting the reception path (Rx, Rx')

Rx') to the antenna (A, A_1, A_2, A_3, A_4), wherein the antenna-switch (SW, SW'), controllable by the signal processor, allows multi-frequency operation of the antenna-terminal (AT) by combining a transmission-mode and a reception-mode of each of the plurality of antenna (A, A_1, A_2, A_3, A_4).

2. (Currently amended) Transceiver apparatus as claimed in claim 1, characterized in thatwherein the signal processor is an analogue-digital signal processor formed by a direct digital synthesizer (DDS) driven phase locked loop (PLL) radio frequency (RF) signal generator.

3. (Currently amended) Transceiver apparatus as claimed in claim 1 or 2, characterized in thatwherein the frequency conversion circuitry ($\mathcal{G}, \mathcal{G}'$) comprises at least one of a local oscillator (Θ) and a power divider (D) to supply a local oscillator power to the transmission path (Tx, Tx') and/or the reception path (Rx, Rx').

4. (Currently amended) Transceiver apparatus as claimed in claim 1 or 2 of the preceding claims, characterized in thatwherein the frequency conversion circuitry (\mathcal{G}) comprises a mixer device ($\text{Tx}2, \text{Rx}2$) for converting the signal between an intermediate frequency (IF) and a radio frequency (RF).

5. (Currently amended) Transceiver apparatus as claimed in claim 1 or 2 of the preceding claims, characterized in thatwherein the frequency conversion circuitry (\mathcal{G}') comprises a direct conversion device ($\text{Tx}1', \text{Rx}1'$) for converting the signal between a base band

frequency (zero-IF) and a radio frequency (RF), in particular by means of an IQ-method.

6. (Currently amended) Transceiver apparatus as claimed in claim 1 of the preceding claims, characterized in that wherein the antenna switch (SW, SW') comprises a matching unit (6) formed as a frequency regulated matching filter (FIG. 8) in order to provide an optimal matching factor for the antenna.

7. (Currently amended) Transceiver apparatus as claimed in claim 1 of the preceding claims, characterized in that wherein the antenna switch (SW, SW') comprises a bus connection (6') to the signal processor (DDS), wherein the bus-connection (6') is formed as a matching network.

8. (Currently amended) Transceiver apparatus as claimed in claim 1 of the preceding claims, characterized in that wherein the antenna switch (SW, SW') further comprises a beam forming matrix device, in particular a Butler-output-matrix (BM) selected from the group consisting of: a 4x4, a 8x8 and a 16x16 Butler output matrix.

9. (Currently amended) Transceiver apparatus as claimed in claim 1 of the preceding claims, characterized in that wherein matching units (MF1, MF2, MF3, MF4) are provided inside the Butler-matrix (BM), in particular a modified Butler-output matrix output/input is formed as a frequency regulated matching filter (FIG. 10) in order to provide an optimal matching factor for the antenna.

10. (Currently amended) Transceiver apparatus as claimed in claim 1 one of the preceding claims, characterized in that wherein the antenna terminal (AT) comprises a patching unit (PU) formed as a low-pass-filter to improve the matching of the antenna for different frequencies and/or for different modes of a multi-frequency communication system, in particular of a mobile cellular communication system or a personal communication system.

11. (Currently amended) Transceiver apparatus as claimed in claim 1 one of the preceding claims, characterized in that wherein the antenna terminal (AT) comprises a matching unit for the antenna, in particular an LC component (L1, C1, L2, C2, L3, C3, L4, C4), in order to provide an optimal matching factor for the antenna.

12. (Currently amended) Transceiver apparatus as claimed in claim 1 one of the preceding claims, characterized in that wherein the antenna terminal (AT) comprises at least two (FIG. 6), in particular four (FIG. 3), antennas.

13. (Currently amended) Transceiver apparatus as claimed in claim 1 one of the preceding claims, characterized in that wherein the antenna is formed as an s-loop antenna having two ends (CP1, CP2) formed as the transmission connector and/or the reception connector.

14. (Currently amended) Transceiver apparatus as claimed in claim 1 one of the preceding claims, characterized in that wherein the antenna is configured as a copper wired antenna,

in particular as a flexible line antenna made of copper.

15. (Currently amended) Transceiver apparatus as claimed in claim 1 of the preceding claims, characterized in that wherein the antenna is configured as a SMD-planar antenna.

16. (Currently amended) Transceiver apparatus as claimed in one of the preceding claims claim 1, characterized in that wherein the antenna has a body and the body comprises an integrated patching (PU) and/or matching unit (L, C).

17. (Currently amended) Transceiver apparatus as claimed in one of the preceding claims claim 1, characterized in that wherein the antenna terminal (AT) forms a beam of 360 degrees, in particular the antenna beam is formed within a range of 200 degrees (FIG. 14).

18. (Currently amended) Transceiver apparatus as claimed in one of the preceding claims claim 1, characterized in that wherein the antenna beam comprises a 90 degree beam, in particular the beam is formed by a 50 degree main beam and two 20 degree side beams (FIG. 12).

19. (Canceled)

20. (Currently amended) Method of transceiving a multi-frequency signal in a multi-frequency communication system, comprising the steps of:

processing the signal in a signal processor (DDS) frequency converting the signal in a frequency conversion circuitry (3, 3') operating an antenna terminal (AT, AT') by an antenna-switch comprising a multi-switch, a transmission multiplexer and a reception multiplexer (SW, SW'), wherein the multiplexers are controlled by the signal processor, and transceiving the signal by means of at least a selected one of a plurality of antenna (A, A1, A2, A3, A4) of the antenna terminal (AT, AT') characterized in that frequency converting of the signal in the frequency conversion circuitry (3, 3') is established on a transmission path (Tx, Tx') and a reception path (Rx, Rx'), wherein each of the paths communicates the signal between the signal processor (DDS) and the antenna switch (SW),

frequency converting the signal in a frequency conversion circuitry wherein frequency converting of the signal in the frequency conversion circuitry is established on a transmission path and a reception path, wherein each of the paths communicates the signal between the signal processor and the antenna switch,

wherein multi-frequency antenna terminal (AT) operation is established by combining a transmission-mode of the antenna and a reception-mode of the antenna (A, A1, A2, A3, A4), controlled by the signal processor (DDS), by means of the antenna-switch (SW, SW') which comprises a multi-switch (MSW), a transmission multiplexer (TxMUX) and a reception multiplexer (RxMUX), wherein the multiplexers (TxMUX, RxMUX) are controlled by the signal processor (DDS) via the multi-switch (MSW), and communicating the signal between the transmission path (Tx, Tx') and the selected antenna via the transmission multiplexer (TxMUX) and a transmission connector (CT1, CT2, CT3, CT4) of the antenna and between the reception path (Rx, Rx') and the selected

antenna via the reception multiplexer (RxMUX) and a reception connector (CR1, CR2, CR3, CR4) of the selected antenna.

21. (Currently amended) Method as claimed in claim 20, characterized by directly frequency converting the signal in a frequency conversion circuitry (3') between a base band signal (zero-IF) and a radio frequency signal (RF).

22. (Currently amended) Method as claimed in claim 20, characterized by frequency converting the signal in a frequency conversion circuitry (3) between an intermediate frequency signal (IF) and a radio frequency signal (RF)

23. (Currently amended) Method as claimed in ~~one of claims 20 to 22~~ claim 20, characterized in that wherein a reference of an incoming signal is processed in an antenna switch after checking a beam direction and a signal quality, in particular based on a BER-measurement.

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Canceled)

28. (Canceled)

29. (New) A communications method using a communications transceiver having multiple antennas having respective switches, a transmission path, a reception path, a transmission multiplexer, a reception multiplexer, and a processor, comprising:

the processor controlling the transmission multiplexer and the reception multiplexer such that during transmission the transmission path is coupled to a selected antenna and during reception the reception path is coupled to a selected antenna; and

the processor controlling the respective switches of the multiple antennas such that, at a particular instant in time, each of the multiple antennas is configured as either a transmit antenna or a receive antenna.

30. (New) A communications transceiver comprising:

multiple antennas having respective switches;

a transmission path;

a reception path;

a transmission multiplexer coupled to the transmission path and to multiple antennas;

a reception multiplexer coupled to the reception path and to multiple antennas;
and

a processor;

wherein the processor controls the transmission multiplexer and the reception multiplexer such that during transmission the transmission path is coupled to a selected antenna and during reception the reception path is coupled to a selected antenna; and

wherein the processor controls the respective switches of the multiple antennas such that, at a particular instant in time, each of the multiple antennas is configured as either a transmit antenna or a receive antenna.